



TESTMARK Laboratories Ltd.

Committed to Quality and Service

elements

Testmark and AEL Continue to Grow

OVER THE PAST YEAR, ALL FOUR OF OUR ONTARIO LABS HAVE CONTINUED TO GROW THEIR TESTING CAPABILITIES.

Our business model has always been to invest locally - to put real infrastructure and real jobs in the communities in which we work. The importance of a sound relationship between industry and their local lab cannot be overstated.

The past year has seen over 30 new accredited methods implemented across our locations.

- ✓ All sites now offer microbiological testing, nutrient analysis programs and a robust suite of inorganic chemistries.
- ✓ Capabilities in metals, organics and toxicology continue to expand at our Garson and Mississauga locations.
- ✓ Our cyanide program has been enhanced at our Timmins and Kirkland Lake sites, along with the implementation of mercury by cold vapour.

Our plans for 2016 will see the trend to invest in localized testing continue and the development of more testing capabilities in response to client demand.

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CORROSION TESTING

An important consideration in most engineering projects

The Importance of Quality Control:
STOP CHASING GHOSTS



Corrosion Testing

Corrosion testing is an important consideration in most engineering projects. Whether the intent is to analyze the corrosive potential of water in water treatment, water transport or water holding applications, or understand the corrosive potential of soil when building new structures, determining how corrosion may impact infrastructure should be part of the overall design strategy.



SOIL CORROSIVITY FACTORS:

Soil that is highly corrosive is a large risk factor for in-situ concrete, pipe and metal structures. The nature of the soil in the contact zone immediately surrounding the structure should be analyzed to assess its corrosive potential. Unfortunately, there is no one definitive test for corrosivity; it is a collection of tests, the results of which paint the overall picture of the risk. The main tests to consider are:

- ▶ **Resistivity** – resistivity of soil is a measure of how resistive soil is to ionic current flow. High ionic current flow creates an environment that facilitates soil corrosion reactions, so soils with high resistivity (i.e. low ionic current flow) tend to slow down corrosion reactions.
- ▶ **Conductivity** – is the reciprocal of resistivity. A highly resistive soil is therefore expected to exhibit low conductivity and be less corrosive.
- ▶ **Moisture** – the water content of the soil is a good indicator of the corrosive potential of the soil, and some suggest it is the best predictor of corrosivity. In general, soil with high moisture content tends to decrease the resistive nature of the soil, can carry more destructive reactive salts and ions and fosters greater corrosive reactions.
- ▶ **Particle Size Analysis** – PSA analysis allows one to characterize the particulate nature of the soil. With size classifications ranging from coarse rock through to clay, it provides a profile of the granularity of the soil. Coarse soils

tend to hold little water and are high up on the resistivity scale, while clay soils tend to hold a lot of water and are less resistive and more corrosive. This is particularly true when the water is saline.

- ▶ **Reactive Cations and Anions** – Sodium, chloride and sulphate tend to be highly reactive parameters and the greater their concentration in the soil, the more corrosive the soil.



WATER CORROSIVITY FACTORS:

Corrosive water can lead to pitted and abraded pipes, rusting tanks and can pose a challenge for optimizing chemical water treatment processes. Similar to soil corrosivity, determining the corrosive nature of water means considering a number of tests. Water studies for corrosion should focus on:

- ▶ **pH** – low pH tends to favour corrosive reactions. High pH may create chemical scaling that can help protect against corrosion but it may also foster bacteria such as sulfur-reducing bacteria that can promote microbiologically-induced corrosion.
- ▶ **Field Observations** – field observations with respect to temperature and flow rate are important to assess. Microbiological activity generally increases with increased temperature and so does the rate of some chemical reactions in general. High flow rate has the potential to physically wear at structures over time, and increase the potential for contact with corrosive salts.



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- ▶ **TDS and TSS** – water high in suspended solids causes physical abrasion on surfaces and coatings; high dissolved solids may pose a risk if they are salts or sulphates.
- ▶ **Dissolved Gases** – the presence of significant amounts of dissolved gases (particularly oxygen and carbon dioxide) can induce corrosion.
- ▶ **Reactive Cations and Anions** – similar to soil, reactive parameters such as sodium, chloride and sulphate can signal a corrosive environment.

The following provides a general rule-of-thumb when assessing the main criteria

in soil corrosion studies:

PARAMETER	CORROSIVE CRITERIA IN SOIL
Resistivity	<1,000 Ohm-cm
pH	<5
Sulphate	>150 ppm (>1,500 ppm in water)
Chloride	> 500 ppm (>1,000 ppm in water)

While the above provides a general benchmark, care must always be taken to consider all variables in your project, not the least of which is the actual application and material you are working with (concrete, steel, polymer-coated metal etc.). Testmark can assist in providing testing specific to your requirements.

The Importance of Quality Control: Stop Chasing Ghosts

In the environmental industry, much of what we do concerns trying to get a handle on something big by examining something much smaller. We don't study the "Big" because, frankly, it's too big to adequately measure. So, we focus our efforts on trying to define, understand and measure something small that we hope adequately represents the Big enough to draw some conclusions.

Science has always progressed along these lines. Take the example of Ernest Rutherford and his historical experiments to try to determine the nature of the atom. We now accept that the atom consists of an extremely dense nucleus containing protons and neutrons (and many other particles), and a much larger area outside the nucleus inhabited mostly by fields of moving electrons. However, we arrived at this concept due largely in part to Rutherford's 'Gold Foil' experiment where he essentially beamed alpha particles on to a piece of gold foil and was surprised to find that a certain percentage of them actually bounced back. This made him infer that the atom must have a very, very dense portion in it that is highly charged so that those alpha particles that happen to hit it will be reflected backwards, while other particles are able to pass through the foil. So, atomic theory

got its main thrust not by having the luxury of actually seeing and studying an atom itself, but by experiments designed to infer the nature of the whole from smaller observations.

Field work is much the same. The concept of sampling comes from trying to explain a site-wide phenomenon by only sampling a portion of it. A previous Testmark newsletter discussed some of the pitfalls to avoid when developing and conducting a field sampling program (see Testmark Elements, Summer 2014) and these can be helpful in ensuring the efforts put into any field investigation are in line with what you are trying to determine.

But, even with the best field sampling practices and study design in place, the data is meaningless without incorporating and assessing quality control measures to confirm the effort you allocate into studying the "small" is a confident approximation of the "big". Without proper quality metrics in place, what you think you may be seeing might not be the case. If there is one aspect of the scientific method that holds dear to us, it is the notion that nothing is certain until proven so. If you are making decisions based on data, then you need to adopt enough of a quality control program to ensure you aren't chasing ghosts.

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QA/QC Checklist

If your sampling program is to be defensible and representative, we encourage you to take the time to review the following guidelines and try to incorporate some of the field QA/QC items below into your project design:

FIELD QA/QC:

		WHAT?	WHY?	RECOMMENDED FREQUENCY?	OUTCOME?
BLANKS	Field Blanks	Lab-grade deionized water used in the field to fill sample containers as you would a regular field sample.	Tests quality of lab water and sample bottles, and contamination from the sampling process or from the background site conditions.	1 blank/day/matrix or 1 blank/20 samples/matrix, whichever is more frequent*.	Results should be in the range of 5x lower than all sample results. Note: Field and trip blanks must be treated as though they were actual samples. Regard must be given to hold times and temperature requirements.
	Trip Blanks	Sample containers filled with lab-grade deionized water that are transported from the lab to the site and return unopened.	Determine contamination that might arise from lab water, sample bottles and from transport and storage.	1 blank/cooler containing volatiles*.	Results should be in the range of 5x lower than all sample results. Trip blanks are intended more for studies involving volatile organic analyses as volatile compounds can sometimes diffuse through container walls and lids and are more mobile contaminants.
	Equipment Blanks	Lab-grade deionized water run over or through clean sampling equipment and collected as a rinsate.	Tests for contamination originating from sampling equipment or carry-over contamination from reuse of equipment.	Once per sampling event or when new equipment is introduced.	Results should be in the range of 5x lower than all sample results.
SPIKES	Trip Spikes	A Trip Blank that is spiked at the lab with a known concentration of an analyte of interest prior to transport to the field. Spiking solutions should not be greater than 5x average environmental levels or you may mask interference effects.	Intended to gauge the analytical accuracy of a laboratory method by assessing the percent recovery of a compound introduced at a known concentration.	Once per sampling event (particularly intended for volatile organic analyses)*.	Large biases (positive or negative) may indicate that the method or instrument is ineffective for that matrix. Poor recoveries may also imply problems with interferences of other compounds and stability issues. These should be further investigated.
DUPLICATES	Field Duplicates	A sample that is homogenized and divided into two sample containers. Samples for volatile organic analyses should not be homogenized but every effort should be made to minimize sampling bias between samples.	An indication of both the precision of field sampling procedures, and to a lesser extent laboratory procedures. Not well-suited for highly heterogeneous matrices. May be submitted to the lab as a "blind" duplicate (i.e. not identified as a duplicate).	A general rule of thumb is that a sampling program incorporate a field duplicate 1 in every 10 samples taken (i.e. 10% of the total samples collected should be field duplicates).	Homogenized field duplicates (i.e. splits from the same sample) can realistically attain results variances of 50-80% or more for water and 80-100% for soil. Sequentially-sampled duplicates can attain variances of 100% or greater due to variability associated with the two distinct sampling events.
	Inter-lab Duplicates	A field duplicate that is sent to 2 or more labs for analysis. Care must be taken that each lab utilizes similar methods and instrumentation and initiates analysis at the same time.	Generally lab duplicates (or splits) provide a measure of inter-laboratory precision. Such studies need to be extremely well managed to ensure apple-to-apple comparison.	Typically only utilized if concern exists regarding accuracy of results obtained by a lab.	See notes under "Field Duplicates" (above). Variability related to laboratory differences in methodology, instrumentation, sample preparation procedures, and sample transport and hold times need to be carefully considered when comparing data sets.

* Source: US EPA

Note: This is presented for general guidance purposes. Attention should also be given to cases where a regulation specifically identifies and mandates a required QA program.

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